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[Original Communication.]

Some Notes on the Chemistry of Gas Manufacture.

By Augustus A. Hayes.

[Concluded from page 4.]

If we examine a number of coals from different basins, their physical characters alone lead us to place them in two classes—laminated, and non-laminated or cannel. Increasing the number of beds represented by hundreds, the physical characters become so diverse, often so curious as to render it impossible to arrange them on such a basis. We are compelled, under the influence of increased knowledge, to add chemical characters to the physical considerations. Here we enter on the firm ground of experimental observation, and most fortunately all the steps of inquiry are leading directly to important points of the manufacture we are striving to bring clearer light.

In the study of coals, a feature of interest connected with their mineral nature is, their almost constant mixture with the same earthy bodies as inclose them. In the pure coals we call this ash, while its composition proves it to be derived mainly from diffusion of silt infiltrating into soft pulp-like matter, and adding weight to the true ash of the vegetation, from which the particular coal was formed. On the other hand the humic paste of the coal material enters into, and is disseminated through some thickness of the covering material, making a part of its mass, coloring it and even modifying its disposition to form strata. This mixture of coal and mineral matter has been called bituminous shale; erroneously connecting it with another and distinct mineral body. The term coal-shales includes Torbane Hill mineral and cannelite, with a large number of like bodies, in no wise bituminous.

RELATION OF COALS TO HEAT.

The preceding remarks are introductory to the subject of special importance in manufacturing gas; the changes induced in coals by heat. When a coal is slowly heated in a nearly closed vessel, its structural form is generally altered, and often most remarkably changed. Some coals expand and become porous, while others, especially cannels and anthracites, do not exhibit considerable mechanical alteration, in the higeest temperature. Expansion affects the value of a coal, so far as it requires more space in retorts, and if it really tumifies irregularly, much care in decomposing it.

The chemical reactions cause these mechanical differences observed in coals. In carefully watching the changes produced by managed temperatures, we see the coal disengage more or less aqueous vapor, followed by matters of organic origin which adhere to all earthy bodies, and the cessation of aqueous vapors marks the temperature at which the particular sample of coal has parted with its absorbed moisture, and its volatile adhering, or easily decomposed foreign matter. If we carefully note the temperature of the mass, we find that perfect coals undergo no change of composition, at the *temperature at which lead melts*. Here is a feature so different from what we observe, when we heat ordinary vegetable matter, as to establish a mineral-like constitution and action.

No further change immediately follows at the given temperature, but as the heat increases it is absorbed, becomes lost as it were, in an effort of the coal to change its state. Motion in the parts of the mass most heated becomes evident, and at the same moment gas and vapors begin to escape. This condensation of increased heat so to speak, has been necessary to the formation of new—not pre-existing compounds—which show themselves. If we arrest the heat, restore to the mass the gas and vapors, and use all known efforts, we cannot restore either the composition or characters of the coal. It has been decomposed by heat and cannot be recomposed.

In different coals, the precise temperature at which they decompose, becomes of importance both in their analysis and in their consumption for gas, while in the study of them, the point where they cease to lose vapors and begin to take the heat of decomposition, is full of interest.

After a high and increasing temperature has been applied to the vessel, nearly closed to exclude air for some time, the mass ceases to lose weight, and the coke, consisting of carbon and earths distinctive of the particular coal, remains. If precautions have been taken to collect and preserve the gases and vapors produced in the reactions of the heated coal, resort to measure and weight will give us the results of analysis of a coal performed in this way.

It will be apparent to the reader, that much labor is required, if we are in this way to arrive at a truthful statement of the composition of all coals; especially in view of the fact that no two samples from the same bed afford precisely the same results, in the same conditions.

As the composition of coals is a most important part of knowledge, and as we always employ heat in the operations, analysis under its different aspects is worthy of consideration. There are several ways of roughly estimating the value of coals known, we shall pass these and examine the common applications closely connected with manufacturing.

I. Often the information sought is the weight of the elementary substances found in coal, and the direct result is obtained by decomposing coal, not by itself, but in presence of another element, which uniting with the element in the coal, form bodies whose composition is known. Thus all the constituents of a coal may be combined with oxygen, excepting the oxygen in the coal; and if we know the volume of gas used to completely burn the coal in vessels closed from air but open to a vacuum, we find in the products gaseous and fluid, the whole of the elementary substances present in the compound.

There are few technical applications involving a knowledge of the results thus found, but the readiness with which the results can be reached, has brought the method into connections where the errors committed are numerous.

It applies in its minuteness only to the few grains of matter operated on, and not to the mass. It has led to errors in classifying coals, and throws no light on most important distinctions. Pressed into service in calculations on the theoretical production of heat in combustion, it has led to ridiculous statements with the falseness of assumed truth, and has no important connection with the art of manufacturing gas.

II In describing the effects of gradually increased heat applied to coals, it might have been stated that the conditions were those familiar to the manufacture of oily and useful products from coal. Any nicety of the laboratory applied to this mode of working coals, aids in refining and rendering more accurate the results, and we can thus make the operations quite as trustworthy as any determinations made in an elementary atmosphere.

We in this way are near to an important manufacture—the results obtained have a permanent value in scientific applications. Coals may be classed under the characters learned, and the mode of analysis sheds a clear light into the gloom of the gas retort.

III. The application of heat so gradually increased as to allow of its effects being measured or weighed, when a particular coal is the material, can be made the basis of a mode of analysis in which compounds formed are partly identical with those obtained in the gas works. But the behaviour of coals under the influence of a high temperature, *suddenly applied*, is a modification easily made, and we then approach so closely the actual workings in manufacturing, as to make the method one of high practical value in this relation.

If we take from various places of a heap of coal of several hundred tons weight, a few hundred pounds of broken fragments, the workman's hammer will soon reduce them to small pieces, from which a biscuit-shaped pile may be formed. A shovel passed through this pile in opposite direction will make two small heaps, and these reduced again or coarsely powdered directly, will afford an average sample, corresponding with the mass of coal in composition closely.

This average sample reduced in the laboratory to a fine powder, may be weighed in 100 grain portions, and exposed to air at 20° C.; the loss of weight is adhering moisture of cargo exposure. The air-dried powder is to be used in the preliminary steps of analysis. One grain or more of the air-dried sample in the bottom of a test tube, may be heated by a current of air, the temperature of which is known and easily

regulated At 100° C. the fact of existing moisture is learned. Slowly increasing the heat to 200° C., combined water, if present, condenses. The acid or alkaline state of vapors condensed, the presence of sulphur or offensive odors, or formation of a sublimate must be observed. This trial will show by the presence of combined water, whether the assay is in whole, or in part, a lignite, or brown coal; to be rejected in gas manufacturing. As the temperature is increased above 200° C. the omission of the first portion of naphtha smelling vapor, or motion in the powder, denotes the decomposing point; a definite temperature for the kind of coal subjected to the trial. After full ignition, coke like that formed in the retorts will remain, and its purity may be tested by combustion in air.

The Tax on Gas.

In the recommendations of the Commissioner of Internal Revenue, we find that functionary suggesting the reimposition of the tax on gas, from which source he proposes to get $2,500,000 additional revenue. We protest against this tax, which is borne only by large cities, and is paid on an article of absolute necessity. In 1871 the total tax collected on gas was $2,573,122.92. Of this amount seven States paid the following portions:

States.	*Tax on gas,* 1871.	*Population in* 1870.
New York	$889,615	4,382,759
Pennsylvania	420,524	3,521,951
Massachusetts	244,449	1,457,351
Ohio	151,879	2,665,260
Illinois	142,168	2,539,891
Maryland	85,576	780,894
New Jersey	81,078	906,096
Total	$2,015,299	16,244,202

The remaining 22,000,000 of people contributed but $570,000. Eighty per cent. of the $2,015,299. collected from the foregoing seven States was paid by eight large cities, viz.: New York, Brooklyn, Philadelphia, Boston, Cincinnati, Chicago, Baltimore, and Jersey City. Such taxation is manifestly inequitable. A tax on whiskey or tobacco is one that is borne voluntarily, because a man can use the articles or do without them, while no one can do without light. The restoration of the revenue does not depend so much upon the increase of taxes as upon their reduction. A reduction of duties on woollens, iron, and cottons will yield more revenue than the imposition of taxes on gas, railroads, and telegraphs. Of course it would be too much to ask our financial engineers to understand this.—*N. Y. World.*

Experiments with the Induction Current.

MM. P. and A. Thenard communicate to *Les Mondes* the following conclusions derived from recent electrical researches:

1. That vapor of water does not hinder the production of the current of sparks, which decomposes it into constituent gases.

2. The current, while determining the combination of nitrogen and hydrogen, decomposes equally ammoniacal gas; but, in both cases and without absorbent bodies, there is found in the gaseous mixtures a quantity of ammonia quite feeble, but sensibly equal.

3. Nitrogen, under the influence of the spark and the vapor of water, disappears to produce an undetermined body which is believed to be nitrate of ammonia.

4. Gaseous phosphuret of hydrogen is similarly incompletely decomposed by the current, and this decomposition is accompanied with phenomena which prove first, the formation of liquid phosphorus, then solid phosphorus, and, lastly, a body supposed to be the same substance in its amorphous state.

5. The current acting on a mixture of gaseous phosphuret of hydrogen and bicarburet of hydrogen reproduces one at least of the phosphoric alkalies.

6. Under its influence, the bicarburet of hydrogen alone condenses rapidly into an odorous liquid, soluble in ether, but insoluble in water.

7. On the other hand, the monohydrate of methylene is transformed in presence of water into marsh gas, into pure hydrogen, into a powerful acid soluble in water, and into a resinous body differing from the viscous substance furnished by the bicarburet.

Chemical Repertory.

No. 105.—January 16, 1874.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

966. An Air-Bath of Constant Temperature between 100° and 200° C.—H. Sprengel.—Proposing the use of sulphuric acid of specific gravity 1·74, which boils at 200° C., in a bath made of metallic lead, on which this acid does not act. To the top of the double cubical box a leaden worm is attached to condense the evaporated water.—*Am. Chem.*

967. Agriculture Extraordinary.—*Les Mondes* asserts that it is proposed, instead of ploughing or digging the ground, to bore holes, fill them with dynamite, and explode them!

To which we would add that when the potatoes are ready for digging the process need only be repeated.

968. Absorption of Gases by Charcoal and their Spontaneous Liquefaction.—M. Melsens.—This chemist has obtained wood charcoal absolutely pure, and possessed of such high absorptive power that it can concentrate in its own pores its own weight of gas. When charcoal thus saturated with any of the more readily liquefiable gases, such as cyanogen or chlorine, is placed in a glass tube fitted with a neck bent at right angles and closed at one end, and heated too 100° by a current of steam, the gas escapes, and compressing itself in the closed end of the tube passes at once to the liquid state.—*Les Mondes.*

969. Borneo.—Large deposits of bituminous, anthracite, and cannel coal are being worked in Sarawak, and the government there is engaged in raising what is most easily accessible for the use of its own steamers. Cannel coal of great thickness has been found cropping out in fourteen different places over an area of twenty miles; and in the Rajong River, which is navigable for 200 miles, fields equally rich have been discovered. The quality of the coal has already been proved; and there can be no doubt that both in Sarawak and in other parts of the East, on the routes of the great steam lines, coal will be produced in sufficient quantities to fully supply the coaling stations in the Indian Seas.

970. Preparation of Chromic Acid.—[It is in view of the probable future use of pure chromic acid in gas analysis, that we give room to this item.—Ed.] The following method is based upon the decomposition of barium chromate by nitric acid, with the separation of the barium nitrate thus formed, by means of sulphuric acid. Precipitated barium chromate is added to boiling nitric acid (diluted with an equal bulk of water) till completely saturated; the whole is then allowed to cool, when the greater quantity of the barium nitrate crystallises out. To the mother-liquor a sufficiency of sulphuric acid is added, to precipitate the remainder of the barium; the barium sulphate settles readily to the bottom of the vessel. The supernatant liquor, containing chromic and nitric acids, is drawn off and evaporated to dryness on a water bath, when all the nitric acid is expelled, leaving a residue of nearly pure chromic acid, which may be purified by crystallization. By this method, nearly the theoretical quantity can be obtained from potassium chromate.—J. McLellan, Shawfield Chemical Works, Glasgow.

971. Roma Rediviva.—From time immemorial attempts have been made to get rid of the unsightly and unwholesome marsh dubbed Lake Fucino. Cæsar, Claudius, Nero, and in later days the Emperor Frederic II., tried their hands at getting rid of the lake. Prince Torlonia has at last achieved the task, and where Cæsars, emperors, and even joint stock companies have failed, a public-spirited capitalist has succeeded. The conversion of a lake forty-two miles in circumference into dry and profitable land is an achievement which augurs well for the future of Italy. —*Iron.*

972. Water Supply of Paris.—Two new artesian wells have been in course of construction for some years in Paris, one at the Butte-des-Cailles, the other on the Place Hebert. The former has been sunk to a depth of 1,725 feet, and it is expected that water will be obtained at 1,800 feet; its cost will be about $125,000. The other well, like that completed after so many years' labor at Passy, presents great difficulties; and although the work is pushed on with activity, the progress is not more than 16 feet per month; and it is believed that 18 months' time will be required to finish the work. The boring tools now in use are worked by means of a steam engine of 40 horse-power; a load of excavated soil takes from seven to eight hours to raise it to the surface. The object of this well is not so much the increase of the water supply of the city as the establishment of public baths and wash houses at a cheap rate, as the water, as it issues from the well, will be of about the temperature of 95 F.—*Sci. Am.*

973. Chinese Coal.—Baron Richthofen has explored the coal province of Sz-tshwan, in China, and deposited a report with the Chamber of Commerce of Shanghai. It appears that the coal basin of that province is larger than the total area of any other province in China, but that with respect to the extent workable, the depth of the seams, and the quality of the coal, the advantages are with other provinces.

The coal of the province in question lies generally beneath thick strata of red sandstone and clay; the consequence is that the coal can only be worked at the edges of the fields, in the channels which have been formed by rivers, etc.; and, moreover, the quality is mediocre. Still, the existence of this coal has been a great benefit to the country; there is no necessity for planting forests, and the whole surface is given up to agriculture, producing an immense quantity of fibrous and other industrial plants. The smelting of iron is spread all over the province, but the furnaces are all small, 20 to 30 feet in height, and in this case only wood is used, while the blowing is done by bellows worked by manual power.—*Iron.*

964. Patent Oscillating Gland for Flowing Oil Wells.—George Finton, Meadville, Pa.—This invention relates to an apparatus which is fastened to the top of the casing to prevent the escape of oil or gas during the process of drilling oil wells; and it consists in a ball and socket gland which permits the rope from which the iron tool is suspended to pass through the gland oil and gas tight, and to move up and down in the act of drilling without permitting either oil or gas to escape, except through proper orifices. If oil escapes, it may be conveyed to an oil-tank, and if gas escapes it may be conveyed off to a distance, so as to avoid danger.

975. Irrigation in the Rhone Valley.—The plan for the irrigation of the departments of the Drome, Vaucluse, Gard, and the Herault by means of a canal fed by the water of the Rhone, has been drawn up by M. Dumont, engineer for the irrigation in question. The proposed canal is to commence at the Roches des Condrieu, and will take from the river the large quantity of sixty tuns of water per second, which is considered sufficient for 150,000 acres' irrigation; the canal will traverse some communes on hill sides of more than three hundred feet in height. From a place known as the Rocher de Mornas, it is to be carried towards the right bank of the Rhone by means of a syphon three thousand metres in length, and formed of three tubes made of iron plate 2½ metres in diameter. It will be carried over the river at St. Etienne des Sorts, by means of a bridge, which will also form communication between Orange and Bognols. A portion of the water will be diverted at Vaucluse by means of an open conduit for the use of Orange and

three other adjoining communes. M. Dumont estimates the cost of the work at not less than ninety millions of francs, but he calls to mind the fact that the effect of the Cavour Canal, constructed under almost similar circumstances, has augmented the annual revenue of Lombardy by more than 150 millions.—*Iron.*

976. Action of Carbonic Acid on Albumen.—Mathieu and Urbain.—When the gases dissolved in serum of blood are completely extracted, there is obtained an albuminous liquid which does not coagulate even at a temperature of 100°. This experiment, performed with egg albumen, formed the starting-point of the present research. The mercury pneumatic machine extracts not only the gases from albumen, but the volatile salts. The two cases are considered separately. The authors show—(1) That carbonic acid is the agent of coagulation of albumen by heat; and (2) that albumen, deprived of its volatile salts, is transformed into globuline.—*Academy of Sciences.*

977. Photometric.—The following item has gone the rounds very extensively. To gas men it is scarce necessary to remark that it is absurd to call it "a new photometer," which is the prefix of all the Journals, as the only novelty is the ingenious substitute for the Bunsen disc. The superiority of the substitute is by no means apparent.—Ed.

A simple arrangement, which has been devised by M. Yvon, which may be exceedingly useful for many purposes. A piece of paper or card is folded in the middle, and placed upright on a table in such a manner that the two halves form right angles. In the line bisecting the angle thus formed, and at some little distance from its apex, is placed a tube, blackened in the interior, through which the observer looks at the edge of the paper or card. The sources of illumination to be compared are placed at opposite sides of the card. So long as the two surfaces are unequally illuminated, the observer has a perception of relief; when, however, the light is perfectly equalized, he sees what appears to be a plane surface.

978. Detection of Petroleum in Coal Tar Naphtha.—First, test the specific gravity of the naphtha; should this indicate, say, 0·86 or thereabouts, there are some grounds for suspicion as to presence of petroleum. Next, place about 250 c.c. of the suspected naphtha in a flask fitted with Liebig's condenser and thermometer, and distil off all coming over below 115 to 120° C. Take this portion boiling below 120°C., and place in a fresh flask, and distil again, collecting apart all coming over below 85° to 90°C. This is tested as to its odor and specific gravity, and, if petroleum-naphtha has been used, the former is usually sufficiently unmistakeable, but is further confirmed by an examination as to the latter, the extreme lowness of which will decide the point. Scotch naphthas have usually a somewhat lower specific gravity than English; in fact they are frequently met with as low as 0·86. To decide, if genuine, *i. e.*, free from petroleum, make the above-mentioned examination in the manner described, and, if the lowest boiling portion extracted thus from the bulk possess, after the second distillation and extraction, a specific gravity not differing very materially from that of the bulk of the original naphtha, the sample may be considered genuine as regards light petroleum.—Watson Smith, F. C. S.—*Chem. News.*

979. The Catalan Coal Basins (Spain).—The basin of San Juan de las Abadesas in the western portion of the province of Gerona, is mostly under the control of the Veterano company, who own some 3 million square metres of property in that locality. The coal is overlaid by a red sandstone without fossils, believed by geologists to belong to the Permian horizon, and over this is a nummulite rock.

Analyses of coals from the different mines are given; the results of which may be briefly summarized as follows:

Specific gravity	1·28 to 1·32
Fixed Carbon	60 to 78 p.c.
Volatile Matter	18 to 24 p.c.
Ash	4 to 9 p.c.

The coke obtained from these coals is of excellent quality.

The coal basin of la Granga de Escarpe is also described. The number of seams is three to five, which are from thirty to fifty centimetres in width. An analysis of the coal from the Esterella mine in this basin showed:

Average sp. gr.	1·28
Fixed Carbon	66·765
Volatile matters	21·494
Ash	10·753

—*Am. Chem.*

980. Australian Coal.—Great disappointment is felt in Victoria at the report of Mr. Mackenzie, the Government coal-viewer for New South Wales. Hitherto all the coal burnt in Victoria has come from New South Wales and Tasmania. Previous prospectors have held out hopes of coal in Victoria, and considerable sums have been thrown away in testing the alleged discoveries, but Mr. Mackenzie's report is very decisive against any further borings. Borneo, however, threatens, unless the Chinese exhibit extraordinary vitality, to acquire the coal trade of the Eastern seas. Hitherto New South Wales has been supplying North China and Japan, but the discoveries of anthracite, bituminous, and cannel coal in Sarawak will probably affect, to a great extent, the coal trade east of the Straits. Strangely enough the mines of Sarawak—said to produce a steam coal equal to West Hartley—are worked by Chinamen, who, in their native country, possess coal enough to supply the wants of the world.—*Iron.*

981. The English Language.—The words of the English language are a compound of several languages. The language may be looked upon as a complication, both in words and expressions, of various dialects. Their origin is from the Saxon language. Our law terms are derived from the Norman, our military terms from the French, our scientific terms from the Greek, and our stock of nouns from the Latin, through the medium of the French. Nearly all English verbs are taken from the German, and nearly every noun or adjective is taken from other dialects. The English language is composed of 15,733 words—of which 6,732 are from the Latin, 3,312 from the French, 1,665 from the Saxon, 1669 from the Greek, 691 from the Dutch, 211 from Italian, 106 from the German (not including verbs) 90 from the Welsh, 75 from Danish, 56 from the Spanish, 50 from the Icelandic, 31 from the Swedish, 31 from the Gothic, 16 from the Hebrew, 15 from the Teutonic, and the remainder from other languages.

American Water-Gas Researches.

A LONG DEFERRED PROMISE FULFILLED.

[It is at length apparent to the undersigned that the time has arrived, at which it has become appropriate—indeed he may add, necessary—to place before the public the results of an extensive and conclusive investigation in this direction, made five years since. Two hundred copies only of the Report which he now commences transferring to these pages, were at the time printed and circulated *privately*, a course adopted by the parties interested for purposes of their own, and for which therefore the authors of the report are not responsible. The undersigned will add that he has procured the consent of Prof. Silliman for this publication.—Henry Wurtz.]

REPORT OF PROFS. SILLIMAN AND WURTZ.

THE PROBLEM STATED.

The Gwynne-Harris Process claims to be a successful solution of a problem in the practical chemistry of gas-making, which has been attempted before during the past thirty or forty years;* *namely*, so as to employ the non-illuminating but combustible gases produced from the decomposition of water by contact of its vapor with red-hot carbon, as to give to them—when united with the gases and other carbo-hydrogens, obtained from bituminous coal or other hydrocarbons—an average illuminating power and permanency which shall make the joint produce an equivalent in illuminating power to the best coal-gas, while securing also from the same materials a largely increased volume of gas at a nominal increase in cost; or, what is the same thing, to obtain a given volume of gas of a certain candle-power, at an important reduction of cost.

PECULIAR FEATURES OF THE GWYNNE-HARRIS METHOD OF PRODUCING THE HYDROCARBON GAS.

The Gwynne-Harris method of making the Hydrocarbon Gas embraces the following essential and peculiar features:

1. The use of clay retorts in place of those of iron, for the decomposition of the superheated steam.

2. The manner of drying and superheating the steam, by the use of superheaters of clay set in the hotter parts of the bench, thus securing a perfect conversion of every particle of watery vapor into superheated steam of very high temperature before it enters the anthracite retort.

3. The mode of distributing the superheated steam in the anthracite retort by means of a false or cellular bottom, formed of perforated tiles; securing the flow of the superheated steam, in a regulated manner, from below upwards, by numerous small openings through the highly heated anthracite. By this disposition of the process the decomposition goes on regularly, and with results as nearly uniform as possible.†

4. The manner of conducting the mixed gases from the decomposition of the superheated steam into bituminous coal retorts, so as to secure the regular and uniform admixture of the hydrogen and carbonic oxide gases with the products of the bituminous coal distillation; thus producing an illuminating gas of uniform composition and permanent character.

* For an outline of previous researches and experiments in this direction, those who are not familiar with the literature of the subject are referred to the *Supplement to Ure's Dictionary* (Appleton's edition), article *Coal Gas*, or to *Ronalds and Richardson's Chemical Technology* (2d edition, London 1855, p. 625). For fuller details, reference may be had to the original papers of Dr. Frankland, Mr. Barlow, Dr. Fyfe, and others, in the first four volumes of the *London Journal of Gas Lighting*. The 2d edition of *Clegg's Treatise on Gas Lighting* (1853), pp. 148-169, also contains a summary of the methods of hydrocarbon gas-making in use in England under White's patent, with figures of the apparatus employed, which, in the light of our present experience, is calculated to provoke a smile.

In fact, on looking back from our present standpoint to the process as it then existed, its failure seems a most natural and inevitable result of the very imperfect apparatus employed. This failure excites neither surprise nor apprehension of its recurrence; success under the experimental conditions then adopted was impossible for several important reasons, which will appear from a perusal of this Report.

Perhaps no better illustration of the state of mind of the most eminent gas engineers, and of the state of the art also can be found than is exhibited in the following remark of T. G. Barlow, Esq., one of the best of English engineers, and the eminent editor of the *London Journal of Gas Lighting*. In his journal for June 30th, 1852, while reviewing Mr. Clegg's estimates of the cost of this process, speaking of wear and tear, he says (p. 35-):—"He (Mr. Clegg) is, perhaps, speculating upon the use of clay retorts in the manufacture of water-gas; but he will soon find, as others have done who have already tried the experiment, that their porous nature renders them totally inapplicable to the retention of such gases are obtained by the decomposition of water and" (qu. ? *by*) "carbon. Metal retorts must consequently be used," etc. We now know that clay retorts are the only retorts which can be successfully used in the hydrocarbon process. Mr. Barlow's remark was probably predicated upon the idea, then common, of the low density of the gases produced by decomposing watery vapor by hot carbon; which a little reflection would have removed. The fact is, the mixed gases from this decomposition even when most free from carbonic acid, have a considerably greater density than coal-gas, ranging from 462 to 488, and, moreover, often by this method contain but little more hydrogen than the average quantity found in coal-gas. This notion, that clay retorts could not be successfully used in the hydrocarbon process, has retarded the general introduction of the method by many years, and has been first successfully overturned by our American Inventors.

† It is both curious and instructive in this connection to read the remarks of Clegg (2d Edition) on the comparative advantages of introducing water or steam into the carbon retorts. Since 1852 the employing of exhausters requiring the use of a steam engine has become all but universal in gas-works, and the difficulties supposed by Clegg to stand in the way of the use of steam are not only purely imaginary, but we are at a loss to understand how a practical engineer could have entertained them for a moment. Another remark by Clegg, prefatory to his notice of the hydrocarbon process, is characterized by great sagacity. He says (p. 148):

"The present arrangement of the apparatus for this process is defective in some points of detail, especially in the water-retorts. This is incidental to all new manufactures; and, *as the theory of the hydrocarbon process is undoubtedly correct*, there can be little doubt that ultimately such modifications will be introduced as will render the manufacture as certain as that of ordinary gas-making." This prediction appears now to be fully confirmed by our working results, on what we may with propriety call the American plan.

The importance of these last two features in the hydrocarbon process will be better understood if we revert to the difficulties which fifteen years ago were encountered by the projectors of White's form of the process in England, from the want of any available method, then known, of regulating the uniform production of the water gas and its admixture with the illuminating gases from bituminous coal. At the conclusion of a series of *five days'* experiments on White's process, Mr. T. G. Barlow sums up as follows (*London Journal of Gas-Lighting*, July 10, 1854, p. 475); "The experiments herein recorded are, in my opinion, *conclusive in favor of the soundness of the hydrocarbon theory*; but considerable difficulty exists in its practical application on an extensive scale, from the following amongst other causes:

"1. The uncertainty in the rate of its production, arising from the difficulty of maintaining the water retorts at a sufficiently elevated temperature to insure the uniform decomposition of the steam.

"2. The large quantity of carbonic acid produced in proportion to the combustible gases.

"3. The difficulty of maintaining the proper proportion between the water-gas and the cannel-gas, so as to produce uniformity in the quality of the combined gases."

It suffices to say here, that at the conclusion of our *five months'* operations on a working scale with the American improvements in the hydrocarbon process, all these difficulties have disappeared; and we may add with truth, that the following propositions by Mr. Barlow, which he propounds as conditions essential to the successful conduct of the hydrocarbon process on a large scale, have been fully realized in our Fair Haven experiments, viz.:

"1. That the temperature of the water retorts (our *anthracite retorts*) shall be maintained at 1,500 degrees or upwards with an expenditure o no more than 60 pounds of fuel per 1,000 feet of water-gas produced.

"2. That the greater portion of the carbonic acid produced shall be converted into carbonic oxide, before its admission into the cannel retort.

"3. That the water-gases shall be supplied to the cannel retort in such proportions as to produce uniformity in the quality of the combined gases." *Lond. Jour. Gas-Lighting*, July, 1854, p. 477.

An examination of the analytical results in this respect, will show that the average content of the unpurified water-gas in carbonic acid, does not exceed 10 per cent., and when the retorts are kept at a proper temperature, this is as low as 3 per cent.; while in no case has the smallest trace of carbonic acid been detected in the purified gas. Moreover, the expenditure of fuel to the 1,000 cubic feet of water-gas is very much less than 60 pounds. (See the section on the cost of making gas by the Gwynne-Harris method, for details, page 64.)

SIMPLICITY OF THE MANAGEMENT OF THE APPARATUS.

The arrangement and practical management of the Gwynne-Harris hydrocarbon process, in its details of daily operation, are characterized by a remarkable simplicity which is much in favor of its success. It can be easily applied to any existing coal-gas retort-house, without any important or costly changes of construction, and without interruption in the regular supply of gas. No addition to the skilled labor in use in every well-regulated gas-house is required. The manipulation of the wheel-cocks by which the flow of steam is regulated to each bench, is acquired without difficulty by the firemen, who soon learn to judge exactly of the proper action of the anthracite retort, by the degree of force with which the volume of mingled hydrogen and carbonic oxide issues from the connecting pipes when the lids are removed from the bituminous coal retorts in the charging. All practical gas men and managers who have witnessed the facility and certainty of this part of the process, have expressed both surprise and satisfaction at the ease with which the difficulties connected with the introduction of the steam, its regular decomposition, and the steady outflow and control of the resulting gases, have been overcome in this form of apparatus.

[To be continued.]

The Circulation of Water on the Surface of Our Earth.

[Continued from page 7.]

From the power of attraction exerted by the heavenly luminaries, we now make a transition to their heating power. As in connection with the former we disregarded the tide-producing force of the planets, being immeasurably small, so we may here leave the moon out of the question, which, to be sure, does not produce cold, as was formerly thought, but whose heat is so inconsiderable that the attempts at demonstrating its existence have only quite recently led to any result. Here, therefore, we need to take into consideration only the sun, whose heat is so great that it could melt an ice-crust surrounding the whole earth to a depth of 100 feet in one year. With every degree of heat, not only water, but even the ice at its surface, is transformed into an invisible gaseous body, aqueous vapor, which becomes again visible only when it reassumes the liquid form as mist or cloud. This evaporation increases with the expansion of surface, and is the greater the higher the temperature rises—therefore greatest in the torrid zone. Mixed with air, the aqueous vapor rising there, flows in the higher regions of the atmosphere towards the poles, and is condensed, according to the degree of cold, to rain or snow in the air, or to dew or hoar-frost on the ground. Such a process is called distillation and sublimation. As water, at its evaporation, precipitates the substances which it has dissolved, rain-water, having gone through a process of distillation, is pure. If by artificially increasing the surface, we increase the evaporation, as is done in southern France in the evaporation of sea-water for obtaining salt, we gain a still more direct conception of this uninterrupted chemical process. The atmosphere, therefore, as is implied by its name, may be considered a great steam-apparatus, whose water-reservoir is the sea, whose furnace is the sun, and whose condensor is the higher latitudes. If the rain immediately falls back into the sea, it will again diminish the quantity of salt increased by evaporation: and old mariners report that, at a time of uninterrupted violent rains in the region of the calms, this is the case in so great a measure that drinking-water may be drawn from the surface of the sea. For this reason the quantity of salt in the sea near the equator, in the region of the calms, is less than in the district of the rainless trade-winds, and decreases again at the tropics, where the descending upper trade-wind occasions new precipitates—the so-called sub-tropic rains. If the rain, however, falls upon the land, it will penetrate into the soil, if it is porous, or immediately flow off from the higher to the lower places, if it consists of rock or waterproof clay.

Now, the surface of the earth consists to a great depth of superimposed layers lying horizontally in the plains, but sloping in mountainous regions. At the summit of mountains, therefore, the gaping edges of these layers come to light, since at the rising of the mountain the connection of the layers was disturbed, and the upheaving mass became solidified in the shape of crystalline rocks. If, now, porous and waterproof layers alternate with one another, those layers will be filled with water whenever the rain in the mountain falls upon these gaps. Our language has no appropriate word for this phenomenon, which the French call "*un nappe d' eau*." A clear conception of the arrangement of the strata can be formed if we lay sheets of wet blotting-paper and dry writing-paper alternately upon each other, and raise the bundle to an acute angle.

If two vessels are connected at the bottom by a tube, the water poured into one of them will rise in both to the same height, however different their width and shape may be. If, at the sea-shore, a bent tube is led through a dyke, the water will, in the upper part of the tube, be on a level with the sea. If a drop of water falls into this tube, the whole ocean will rise in a proportion diminishing in the ratio of its greater surface This law, of course, holds good for any number of vessels connected by pipes or tubes. An illustration of the application of this law is furnished by the *suterazi* of the Turks, who, when desirous of conducting water from one mountain to another, construct a stone pipe leading from the slope of the former transversely through the valley, and then again up the slope of the latter. If the Romans had known this principle, they would not have constructed their arched aqueducts, which give more brilliant evidence of their art than of their knowledge of nature.

The arrangement of aqueducts in large cities is an imitation of these *suterazi*. A main reservoir is filled to considerable height with water: the connecting pipes branch off in all directions under the pavement, and from the latter the communicating pipes, which, of course, can be filled with water only up to the level of the main reservoir, are conducted into the houses. The tendency of the water to rise is, of course, everywhere manifested in a uniform manner; consequently the upper horizontal covering of the pipe receives an upward pressure from the rising water. If it is unable to resist this pressure, the water rushes out and forms a spring. The many proofs of these phenomena which the English company gave when establishing the aqueduct in Berlin, have been furnished only to render the theory of springs more popularly known: for what else, indeed, are those *nappes d' eau* than the water in those pipes, whose walls represent the waterproof layers of the latter? Therefore, the springs gush forth at the foot of the mountains, where the upper covering broke at the time of its bending, but often, also, at a great distance from it, when the layer which is still unbroken at the foot of the mountain is discontinued in the valley, or broken at some place. If the layers lie horizontally on both sides of a so-called valley of erosion, the water issuing from them can have no power of ascending, unless the layers assume at a greater distance an inclined position. Often nature has neglected to provide an opening through which the spring is to gush forth, and must then be aided by art. In such a case the upper layer is pierced with a drill, and in such a way an artesian well is obtained.

The irrigation of the low oases in the Sahara seems to have been produced since the most ancient times by artesian wells. Shaw relates of Wad-reag, a collection of villages on the border of the Sahara: These villages have no springs. The inhabitants procure water in a singular manner. They dig wells to a depth of 100, sometimes of 200 fathoms, until they strike a stone under the sand similar to slate, under which they find the *Bahar tahr el erd*—i. e. the water. This stone can easily be pierced, and then the water gushes forth so suddenly and in such abundance, that those who have gone down in search of it sometimes perish, although they are drawn up as quickly as possible. Already Olympiodorus gives a report of the digging of such deep wells in the great oasis. They are called Bahr in the erosions of the low plateau of the desert, but Schreia on the plateau itself.

When, in 1854, after the battle near Meggarin, Gen. Desvaux was encamped in the oasis Sidi Rasched, he noticed that on one side of it the palm trees had a rather sickly appearance, while in other places they looked vigorous and healthy. When inquiring about the cause of this singular phenomenon, he received the reply that it was the want of water, since one of their main wells had broken down, and they had no means of digging a new one; so they were now awaiting the day when their palm trees would cease bearing fruits, and they would have to starve, in accordance with Allah's will. The general then resolved to send to France for a boring apparatus at his own expense. An engineer of the Paris firm, Degousse, was immediately summoned, who found the matter feasible. The following winter, after four days' work by a company of Spahis, a spring yielding 4,300 litres per minute gushed from the abandoned shaft. The natives hurried on in great numbers, rushed over the blessed spring, and bathed their children in it. From all the oases petitions were now sent in for a similar favor, and about fifty wells were bored without causing any essential diminution in those previously bored. With an exaggeration that is in keeping with the tendency of the times, the hope has been even expressed that in such a manner the desert at some future time may be converted into a fertile garden.

The abundance of water in a spring may occasion

ally cause embarrassment. Some years ago a landed proprietor in Italy ordered an artesian well, but the spring they struck was so powerful that it submerged his estate and those of his neighbors. All efforts to close the spring again were in vain. In consequence of the law-suits instigated against him on account of the damages caused thereby, he lost his whole property. Goethe's tale of the wizard's apprentice had been realized to his misfortune. Sometimes the waterproof layer upon the summit of the mountain covers the openings of the porous ones, so that they cannot be filled with water. Thus it was near Marseilles, where the fertile soil of the vineyards was often completely washed away by violent rains. The vintagers conceived the plan of piercing the covering layer of clay by deep holes, and dug canals which conducted the water into them. Since that time springs have been formed at the sea-port of Marseilles of the diameter of a man's arm, which were previously unknown there. In 1831 the artesian well on the square before the cathedral in Tours raised branches and shells from a depth of 335 feet.

Can any one, with the evidence furnished by these phenomena, still entertain any doubt that the water gushing forth from natural springs does not differ from the water penetrating into a mine from the upper strata, which gives so much trouble to miners, and to overcome which they dig channels above the mines to quickly lead off the water and prevent it from penetrating the latter? How many springs give out after a time of long drouth—many so frequently that they are called hunger springs—in contrast to the spring-wells of Switzerland, which every where gush forth in spring-time at the first thawing of the snow! Nevertheless, here are even in our day supporters of the so-called capillary theory. It is true, that in a narrow glass-tube the water rises with a concave surface higher than in a wider vessel in which the tube is placed; but this higher elevation can take place only as long as the surface is concave. If it is to flow out, the surface must first become level; and this can therefore not take place, because then the condition of the higher elevation is wanting. It may also be observed that a lump of sugar dipped into coffee will absorb it till it is filled, but no coffee-spring will gush forth from it.

[To be concluded in our next.]

New Gas Movement in Buffalo.

The following paragraph appeared in the Buffalo papers of Jan. 5th, 1874

MORE LIGHT—ORGANIZATION OF THE CITIZENS GAS CO.

At the recent sale of the Oxy-hydrogen Company's works, the property and effects were bid off by various individuals and parties who have since organized a new gas company under the title of the Citizens Gas Company.

A meeting of the directors was held at the office of C. A. Sweet, Esq., on Saturday, and the following officers were electedfor the ensuing year.

President—J. F. Schoelkoff.
Vice President—J. H. Vought.
Secretary—E. S. Wheeler.
Treasurer and Manager—C. Rodenbach.

The following are the names of the

DIRECTORS.

J. F. Schoelkoff,	John B. Griffin,
J. H. Vought,	C. Rodenbach,
C. A. Sweet,	A. Spitzmiller,
D. Donaldson,	Cha. E. Brown,
J. Roskof,	E. S. Wheeler.

Chas. Ensign.

We understand the company proposes large improvements which will be entered upon at once. The production of oxygen gas was abandoned some time ago and will not be renewed by the new regimen because the demand for it is too limited to warrant its manufacture. They will continue the business as recently conducted; that is, supply their customers with the best of carbonized hydrogen gas, manufactured as heretofore, from water. The pipes will be extended from time to time on new streets as the demands of trade may justify.

[NOTE BY THE EDITOR.—To the above, our private advices from Buffalo enable us to add the following:

The parties who commenced operations at this point to test the practicability of introducing the manufacture of oxygen for illumination into our cities, have, as it would appear, abandoned the experiment, so far as oxygen is concerned, and propose to utilize the existing plant in other ways, so far as possible. Some think that the expenses that have been incurred, of duplicate manufacture and double piping in streets, are a total loss; but we have no detailed information on these heads. They claim to have expended about $275,000 in construction. To obtain money for current expenses, they issued bonds for $100,000 which were taken by the principal stockholders here. In the original organization the capital was fixed at $750,000, one-third of which ($250,000) was issued to pay for the Tessie du Motay oxygen patent. The ailure of the undertaking in that respect, and but partial success in the other, soon exposed the general failure of the company. The bonds were issued under the authority of laws passed in 1867, and especially in 1872, which empowered this issue; which laws are deemed by some to have abolished all the safeguards and restrictions for the public provided by the General law of 1848.

Under this power the parties there foreclosed the mortgage, bought the whole property in for a nominal sum and now reorganize as specified in the published notice.

In the new organization, which, it is stated, is substantially the same as the Oxy-Hydrogen Company, the buyers under the bonds sell to the new "Citizens Company" all its rights, property, etc., for $300,000 which is distributed *pro rata* among themselves, and a new effort is to be made to manufacture and supply gas.

So far as we can surmise, at this distance, they claim some new improvements in water-gas, to be enriched by petroleum,-naphtha, or in some other way, of which but hearsay statements have reached us.]

Lighting the City.

THE COST PER LAMP—CONSIDERATION OF BIDS BY THE COMMISSIONERS—POSTPONEMENT OF THE WHOLE MATTER.

Mayor Havemeyer, Comptroller Green and Commissioner Van Nort met on Wednesday, January 7, for the purpose of awarding the contracts for lighting the streets. The Mayor presided. Mr. Van Nort moved to award the contract for the First District (all that portion of the city below Grand street) to the New York Gas Company, at the rate of $33 for each lamp for the present year. The motion was carried. Another was also adopted awarding a contract to the Manhattan Company.

Mr. Van Nort also moved to lay over the consideration of the proposals submitted by the Harlem and Metropolitan Gas Companies on the ground of informality, and that of the Mutual Gas Company on the ground of expediency. The informality consisted in not sending in the names of the sureties, and in not presenting the bids in accordance with the terms of the advertisement calling for them.

Commodore C. K. Garrison, President of the Mutual Gas Company, said that he had had large experience in mail and other contracts, and that the rule was always to award contracts to the lowest bidders. He said that he owned more gas stock than any other man on the face of the globe, and he therefore knew whereof he spake. The Mutual Company were lowest in their bids for supplying the city with gas in those portions of the city where the pipes were laid. He therefore thought that that company should be awarded the contract.

Mr. A. V. Stout, President of the Shoe and Leather Bank, and an officer in the Mutual Company, said that what the company asked was that they be permitted to bid and compete with other companies, in those districts where the Mutual Company were prepared to supply gas.

Mayor Havemeyer said the whole matter seemed to be a very simple one. It was simply a question as to which would be the most expensive to the city—the proposal of the Metropolitan Company or that of the Mutual. The Metropolitan by supplying the gas at their rates, and being able to supply the whole district (from Thirty-fourth street to Seventy-ninth street) at $37 per lamp, would, he thought, save to the city $5,000 a year, inasmuch as the Mutual could charge even $15 a lamp for the district in which they have pipes laid, provided only a portion of the district was given to the Metropolitan. The Mayor said that there was a time when the city was lighted with gas at a cost of $11.50 per lamp per annum. When gas first came to be used he thought it was better than at present.

Mr. Van Nort's motion to postpone action was adopted.

The meeting then adjourned, subject to the call of the chair.

The districts contracted for are as follows:

First—South of Grand street—3,040 lamps to the New York Company, at $33 each for the year; 400 lamps to the Mutual at $35 per lamp.

Second—Between Grand and Thirty-fourth streets, and from river to river—6,635 lamps to the Manhattan at $33 per lamp.

Districts, the contracts for which were laid over:

From Thirty-fourth street to Seventy-ninth street, and from river to river—4,041 lamps. The Metropolitan Company bid $37 if they light all the lamps in the district, and $39 if only a portion of them. The Mutual Company ask $35.

From Seventy-ninth street to Kingsbridge, from river to river—4,218 lamps; $39 each by Metropolitan Company.

The contracts call for lighting, extinguishing, and glazing the lamps.

Light.

BY DR. VAN DER WEYDE.

[Communicated by the Author.]

In our last issue, we copied from Dr. Van der Weyde an interesting extract on the same topic as the following. He has been kind enough to transmit us in advance the *proof* of the following as set up for his own Journal, the *Manufacturer and Builder*:

One of the strangest incidents in scientific research is that most important discoveries pass by unnoticed, the accounts of them remaining dormant for years, in memoirs published either privately or by scientific societies, until a long time afterward the same discoveries are brought out by others as novelties, and then are fortunate enough to attract public attention for the simple reason that in the meantime the scientific world has advanced far enough to realize the importance of the discovery, while before that time the original first discoverer was too far in advance of his time to see his labors appreciated. These remarks apply directly to one of our most eminent philosophical investigators, Dr. John W. Draper, who thirty years ago published a work entitled "On the Forces which Produce the Organization of Plants." This work was illustrated by engravings made after daguerreotype plates, some of which not only represented the different lines of the diffraction spectrum (quite recently introduced in spectroscopy), but also possessed for a scale the wave lengths as the proper indices for designating the different Frauenhofer lines, and which now have superseded the scale which Bunsen and Kirchhoff brought out some twelve years ago when they first published an account of their spectroscopic researches.

Dr. J. W. Draper discovered also, thirty years ago, groups of lines outside the limits of the line A in the dark red or rather brown extreme end of the spectrum. His son, Dr. Henry Draper, has recently succeeded in making photographs of all the spectral lines, even including those. Thus far it had been accepted that the red end of the spectrum possessed no actinic power, and that therefore it could not be photographed; but Dr. John W. Draper has recently proved that this error is caused by the fact that the blue end of the spectrum acts chiefly on the bromide and iodide of silver, almost exclusively used by photographers; that the yellow portion for instance, acts on carbonic acid and the red on other substances, and that therefore the whole length of the spectrum possesses chemical powers, only different in different regions for different chemical preparations. This view has been verified by Dr. Henry Draper by photographing even the lines mentioned beyond A. He publishes also in the last number of *Silliman's American Journal* some beautiful photographs of many groups of lines, proving the advantage and fidelity of photography over handiwork, as his plates show details not found in the carefully drawn maps of Angstrom, Kirchhoff, Mascart, and others.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

On Naphthaline.

Gas Works, Montreal, Dec. 20, 1873.

Mr. Editor: I had intended to compress all I desired to say on the above subject, in my letter of the 25th October last (and which appeared in your issue of 2nd inst.), but finding it extended to a greater length than was anticipated, and would require more space than could reasonably be expected, I had to close, without being able to add the little left unsaid.

Having stated my views respecting the cause of the generation of naphthaline, and my experience as to its abstraction, as opposed to the experience of your correspondent "W. A. S." I would now respectfully beg to say a few words touching the means usually adopted for clearing the upper pipes when they have unfortunately become choked with it.

All know that a deposit of naphthaline can be dissolved by steam, and removed by being pumped out of the pipe with the condensed steam; that being the usual means adopted, especially when the obstruction is within the works; but it may perhaps not be so generally known by those happily not much troubled with this nuisance, that unless the pipes have a good "fall" or inclination, and consequently the syphons or receivers be wide apart, there is the contingency of the dissolved scales cooling and solidifying into crystalline lumps, of the consistency of ordinary washing soda, but of an amber color. When this has taken place no subsequent steaming will dissolve them. As an instance it may be mentioned, that a few years ago I had occasion to lift a 12-inch main, owing to its being completely choked up. It was laid under a large coal shed, and nearly level, so that in frequent steamings the dissolved naphthaline had cooled and solidified. A piece about the size of a hen's egg was unaffected when held in a stream of steam of 40 lbs. pressure, but it speedily dissolved in naphtha. This shows how futile it is to steam a pipe, unless the condensed steam and dissolved naphthaline can be pumped hot and thick from the nearest receiver, to which end it is desirable to have the suction pipe of the receiver of not less than $1\frac{1}{4}$ bore. Where the nearest receiver is some distance off, it is necessary to simultaneously warm the pipe from the receiver back to the stoppage, by inserting steam pipes (each with a stop-cock attached) at certain distances apart, and partially closing all the cocks when the main has become warm, except the one nearest the stoppage. By this means crystallization can be prevented and the stoppage removed, even in a considerable length of piping. If naphtha be poured into the pipe before the steam is turned on, the clearing will be greatly facilitated, the vapors of naphtha acting rapidly on the naphthaline. Indeed, by means of a small portable boiler, and careful manipulation, diluted naphtha can be pumped into the boiler, and its vapors be made to act with the steam, even in street mains affected.

Perhaps the inlets and outlets of the gasholders inside the tanks are the most difficult pipes to clear in the works, owing to the cooling influence of the water. A convenient way in such cases is to "plunge" the pipes, but it is only applicable where the gasholder valves are quite tight. The operation is as follows: Shut down the valves of both the inlet and outlet pipes; fill the pipes with water; remove the covers on the top of the pipes, and bolt a flanged pipe say six to eight feet long on each. A temporary platform being erected, a loose fitting piston or plunger of sheet iron with rod attached, is worked up and down, giving a violent oscillating motion to the water, which removes the adhering naphthaline, a portion of which floats to the surface, and is washed over into the tank, the remainder being pumped up with the water in emptying the pipes. While on the subject of gasholder pipes, attention may be called to the simple, ingenious, and inexpensive contrivance for obtaining independent access to the pipes in the tank, without mixing air with the gas in the crown of the holder, patented by Mr. George Livesey, engineer of the South Metropolitan Gas Works, London, in December, 1869, and published in the English *Journal of Gas-Lighting* in the number for January 3, 1871.

The greatest trouble, and generally the only trouble with naphthaline in the district, is its choking up of the consumers' and lamp service pipes. With reference to the former, the readiest cure is to blow the naphthaline back into the main, by means of a "service cleaner," being a convenient adaptation of the force pump. In lamp services this plan is not suitable, and as all know, the most convenient remedy is to pour a small quantity of naphtha, or "high-wines" down the pipes, although sometimes in either case, the use of a long piece of cane has to be resorted to. Curiously enough these obstructions in the service-pipes are more numerous in the fall when the cold weather first sets in, and again in the spring when it is leaving.

Reverting to steaming, it may be admitted, that there is the disadvantage of the removal of the oleaginous internal surface from the pipe, and which leaving the original rough surface, is provocative of a repetition of the evil, but as there are no advantages without some attending disadvantages, this contingency has to be submitted to.

I may just further observe before quitting the subject, that it will be sufficiently obvious, that the views of "W. A. S." and my own, are considerably opposed to each other. That gentleman, if I rightly understand him, seems to hold that because naphthaline is rich in hydro carbon, it is the result of distilling coal at a low heat, while I have endeavored to show it to be a secondary product, the result of high heats; and he advocates the efficacy of copious washing (and consequent sudden cooling) of the raw gas, while my experience on the contrary, leads to the conclusion, that water itself is not efficient for the absorption of naphthaline, but that *gradual cooling in contact with tar* is. These are our contrasted views, and if from their friendly flint and steel, any useful sparks of information shall have been struck, or suggested, I shall be abundantly satisfied, and I presume "W. A. S." will be equally so. The little I had in mind to add, in respect of tar as retort fuel, must, I find, be still deferred, to avoid this letter running into such an intolerable length as my last.

Yours truly,
E. S. Cathels.

On Naphthaline.

117 Broadway, New York, Jan. 5, 1874.

Mr. Editor: In two recent numbers of your paper have appeared correspondence on naphthaline—one from "W. A. S." September 7th, and the other from Mr. Cathels, December 2nd. The fraternity are much indebted to both of those gentlemen for the information contained in their respective letters. W. A. S. says if the fraternity would compare notes, we should be on the high road to positive knowledge. I accept his suggestion, and can say that I have met the *enemy* and believe I have conquered.

About the 1st of July last I commenced the use of "Clark's Combined Condenser, Scrubber, and Exhauster," and without proper care set it too near my hydraulic main, the effect of this was that the gas entered the condenser, etc., at a temperature of 104° F., and in passing the five feet of the condenser, etc., was reduced from that temperature to 70°; the tar in passing this distance being so completely extracted, that scarce a tinge of it was to be seen in the purifiers.

The fact of the gas leaving the condenser, etc., at so high a temperature as 70° with the tar out, gave me much anxiety, fearing naphthaline, so I watched carefully the course of events. In about two months the pipes between the condenser, etc., and the purifiers began to show signs of stoppage, and in less than a week after that did completely stop up, from the condenser, etc. to within a few feet of the purifiers, with naphthaline. It also showed in the inlet pipe, between the purifiers and the holder. During all this time there was no appearance of naphthaline in the purifiers, or on the under side of the lids to the purifiers.

I removed all this naphthaline by steam, and then commenced a search in the several volumes of Gas Light Journals and other authorities at my command, for the cause of the deposition of naphthaline, and how it may be prevented. I found the cause of its deposition to be the *sudden cooling* of the gas from any given temperature to a much lower one. In my search I found in the English *Journal of Gas-Lighting*, vol. 20 (1871), page 514, the following discussion, which took place at one of the meetings of the English Gas Managers, and in accordance with the suggestions there contained, I added 90 feet to my conveying main, passing round the inside of my retort house, and the last 20 feet of it through a tank of water, fed by a small stream, the cold water passing in where the gas comes out. This reduced the temperature of the gas to 70° as it passes into the condenser, scrubber, and exhauster (a circular apparatus 30 inches diameter and 5 feet high), coming out below 65°. Since that rearrangement I have had no trouble or sign of trouble from naphthaline. There are some excellent suggestions as to naphthaline in "Chemical Excerpt," No. 858, on page 76, of your Journal, September 16, 1873. If these thoughts help to solve the problem of the cause and prevention of naphthaline, I shall be gratified. Yours truly,

Charles Nettleton.

[Here follows a quite extended extract, which, as Mr. Nettleton seems unaware, would be superfluous with us; as, with the exception of a few lines, our readers have already had it (See vol. 15, p. 35, issue of August 2, 1871). Regretting, therefore, the trouble Mr. N. has been to, to put it into manuscript form, we must ask that gentleman to excuse us.—Ed.]

Combination of Hydrogen Gas and Carbon.

National Coal Gas Company,
New York, January 5, 1874.

Mr. Editor: Under the above caption, Mr. King, in your last issue, asserts that "All patents for processes which claim to combine hydrogen and carbon, have utterly failed, and must fail, until there is some new and important discovery in chemical science." He quotes Dr. Frankland as authority, and adds, "I, for years have had no doubt on the subject." It would have been more satisfactory if he had defined his meaning, instead of making a mere general statement, so broad as to be without any point.

As to the lengthy quotation made by Mr. King, I had examined "Clegg on the Manufacture of Gas," of the edition of 1868, and, as you say of your edition of 1866, I do not find it in Dr. Frankland's article. But I do find that Dr. Frankland states *hydrogen* to be one "*of the substances contained in coal gas, or which are concerned in its generation and combustion*," and that "The constituents of purified coal-gas are *hydrogen*, light carburetted hydrogen, carbonic oxide, olefiant gas." Again, he says, "The constituents of coal-gas, and also of other gases used for illuminating purposes, may therefore be divided into two classes, viz., luminous and non-luminous constituents. To the first belong olefiant gas, and the rest of the hydrocarbons; to the second, *hydrogen*, carbonic oxide, and light carburetted hydrogen."

Your columns will not permit extensive quotations, and I will therefore merely give Dr. Frankland's conclusions in his chapter "On the Generation of Coal Gas." He says:

"These remarks indicate the objects that should be chiefly regarded in the generating department of the manufacture of gas for illuminating purposes. These are—

"1. The formation of a due proportion of illuminating and non-illuminating constituents, so that on the one hand the combustion of the gas shall be perfect, and without the production of smoke or unpleasant odor, and on the other that the volume of gas required to produce a certain amount of light shall not be too great.

"2. The extraction of the largest possible amount of gaseous illuminating compounds from a given weight of materials.

"3. The presence of the *largest possible proportion of hydrogen* amongst the non-illuminating constituents, to the exclusion of light carburetted hydrogen and carbonic oxide, so as to produce the least amount of atmospheric deterioration in the apartments in which the gas is consumed."

With the above evidence of Dr. Frankland, I do not see how he can be a very good witness for Mr. King to prove that hydrogen and carbon will not combine.

But as gas producers are generally more interested in actual results than in theories, I refer them to what has been, and now is being accomplished in the production of hydrogen gas from the decomposition of

steam under the Gwynne-Harris, or American Hydrocarbon process, owned by this company; and to all who say that it cannot be done, the reply of the client to his counsel, when advised that the plaintiffs could not put him in jail, "*But they have done it*," is an answer.

Whether in certain conditions, or under certain circumstances, hydrogen and carbon will not combine, I deem of no importance to gas manufacturers, so long as it is well known that they do combine, and form important constituents *in all coal gas*. The report of Professors Silliman and Wurtz, to which I have in former communications alluded, shows that by adding one third of water gas made under our process, to two-thirds of common coal gas, a purer and more permanent gas was produced, than from coal alone.

At Fair Haven, Conn., during nine months, over 6,000,000 cubic feet of gas were made in this manner, averaging 6·41 feet per pound of coal, of 16·91 candle power. At Newburgh, New York, it has been in operation for more than two and a half years, with much greater success, both in quality and cost of their gas, than they ever before were able to accomplish.

To all this is added the fact, that the Citizens Gas Company of Brooklyn are now, and for a long time have been making 100,000 feet of hydrogen per day, and carburetting it by passing it through petroleum oil, which is nearly all carbon, and the result is, an illuminating gas superior to any that can be made from coal alone, and giving more light than can be furnished from oil alone, at anything like the same cost.

If Mr. King will pesonally examine our process in operation, he will be convinced of his errer, and find that facts are better than theories.

Yours respectfully,
H. P. Allen, President.

Tar as Fuel for Heating Retorts.

Milwaukee, Wis., January 4, 1874.

Mr. Editor: We have noticed for some time, communications in your valuable Journal in reference to using tar as fuel for heating retorts. Knowing the same to have been in use over thirty years ago, and still used successfully in Europe, I am surprised at the manner in which some of your correspondents treat the subject, as if it were new, and while thousands of retorts are heated by tar, and tar and coke combined, they assert it as their opinion that "tar will not give the necessary amount of heat to keep up a bench of fives."

In 1870 we made an experiment with tar, injecting it into tho furnace with superheated steam through a nozzle over the furnace door: we were so successful in heating a bench of fives that we melted them down. Our contract for the sale of tar was very good, and we did not try any more experiments; and further, we considered it necessary to reset our benches, to adapt them for using tar in this way.

In the spring of 1872, our contract with the party taking our tar expired: they wished to renew it, hut at very low rates. Having several benches requiring the furnaces renewed, we converted one of them into a tar furnace, putting in a solid fire-brick bottom, giving a slope from front to rear of about 12 inches, projecting the side walls 15 inches in front of the line of the front wall of oven, and covering by arching over, leaving a hole about two inches square in the top, through which the tar entered from the supply pipe. The proper quantity of air was supplied through an opening in the door, regulated by a damper. Succeeding moderately well with this bench, we arranged the adjoining one in the same way, with some slight changes, with which we were entirely successful. carbonizing 6000 lbs. of coal per 24 hours, with from 120 to 130 gallons of tar. We run these two benches for some three months, when our roofing material manufacturers found it was more for their interest to give us a reasonable price for tar, than to import pitch from elsewhere. The process of using tar and coke combined is very well described in a late number of your Journal, but lest any one should be alarmed at the complexity of the "grinding" process there described, we would just say to them, we have used it ourselves for years, and seen it used successfully without anything of the sort. Have your elevated tank in such position that it will be kept moderately warm, without vaporizing the tar, and you will have no trouble with it, flowing freely to your furnace. I trust, Mr. Editor, that these facts may be useful to some of the fraternity where tar is a drug in the market, and help to change the opinions of your correspondent from Knoxville, Tenn.

We are very much interested in the discussion on naphthaline. Working at high temperatures for the last fifteen years, it has been our trouble. We have tried various plans to prevent it reaching our purifiers, but we must confess with very little success. We noticed that the subject was under discussion at a late meeting of the West of Scotland Association of Gas Managers, and that they knew just as little about the subject as we do, the President there stating "that increased condensation was the remedy." We once believed this also, but for seven years we have been using condensers by which we can reduce the temperature of our gas to 45° Fahr., *and yet naphthaline gets into our purifiers*. We have long been satisfied that the condensation was complete, but that the particles are held in mechanical suspension, and are carried by the current of gas to the purifiers. From experiments we have made, we are satisfied that *slow* travel with *friction* was the remedy, and based on these experiments we are constructing a combined scrubber and condenser, that will effectually relieve us from this trouble, until some one tells us how we can produce it as an noncondensable gas at ordinary temperatures. Apologizing for the length of this letter, I am, respectfully yours,

James H. Walker.

Brooklyn Gas.—The Gas Committee and the Finance Committee of the Board of Aldermen and the presidents of the several gas companies, six in all, met at the Brooklyn City Hall, December 25, to consult in reference to a reduction of the price of gas. On motion of Alderman Ropes the gas companies were requested to reduce their rates from $2.50 to $2 per 1000 feet. Mr. Libby, of the Citizens' Gas Company, said that he did not think it possible to make any reduction, and proceeded to show the cost of making gas. If the city, he said, should undertake to build its own works, it would cost $10,000,000, and the amount of interest on the bonds issued for that purpose would make the cost of gas just as much then as it is now. Mr. Benson, of the Brooklyn Gas Company, said that the large dividends which the company had paid were made, not from the gas, but from the rise in the value of their real estate. After some discussion the Committee adjourned, without arriving at any conclvsion.

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

FRIDAY, JANUARY 16, 1874.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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CONTENTS.

☞ An asterisk (*) denotes an illustrated article.

Some Notes on the Chemistry of Gas Manufacture..... 19
Tax on Gas..... 20
Chemical Excerpts..... 20
American Water-Gas Researches..... 21
The Circulation of Water on the Surface of Our Earth..... 22
New Gas Movement in Buffalo..... 23
Lighting the City..... 23
Light..... 23
CORRESPONDENCE—
On Naphthaline..... 24
Combination of Hydrogen Gas and Carbon..... 24
Brooklyn Gas..... 25
EDITORIALS—
1873: Continued—Petroleum..... 26
Municipal Gas..... 27
New Exchanges..... 27

1873: CONTINUED:—PETROLEUM.

In the last issue we broke off, when speaking of the new lines of communication and other movements, and developments in this country which are destined to influence and benefit the world in general to a greater or less degree, by opening new bodies of gas and other coals to new markets. The Chesapeake and Ohio Railroad, and, more especially, the James River and Kanawha Canal (if the latter is ever to be completed) will bring rich cannel coals to the seaboard, for foreign export; but our main object is to direct attention to the great bodies of excellent gas-coals which are now being developed in Eastern Ohio, and Western Pennsylvania, on the lines of railway communicating with Lake Erie ports. The writer has had the opportunity, during a few months past, to take a run through some parts of this country, and is deeply impressed with the great future that lies before it. Some special information regarding coals from this district, will shortly be put before the readers of the Journal.

Of all the developments of 1873, probably the most momentous are those which bear upon the petroleum-product. It has been sufficiently demonstrated that the producing capacity of the country in rock-oil is only to be limited by the demand for this product at prices which will remunerate the producer. The price is now—and bids fair, except slight fluctuations—to remain for an indefinite period, at a point too low to admit of the use (by pumping) of thousands of wells already sunk. In fact the price is so low that it has become apparent to the most unbelieving that petroleum may be, and must be, applied for gas manufacture and for fuel in many cases. The oil-producers themselves have awakened to this, and have felt the spur of necessity, in the direction of finding out new modes of enlarging the demand. Our advices are to the effect that some of them have at last removed from themselves the reproach that has been cast on them, that they want everybody to use oil for gas and fuel, except themselves:—there being now one town at least in the oil regions, Tidioute, which is lighted, and may soon be heated also, with gas made from petroleum exclusively. The writer trusts soon to be able to visit Tidioute himself, and to report on what he there shall see, in this new and pregnant development—his own interest regarding which will doubtless be very widely shared by others.

A fact has been stated to us, even while engaged, *currente calamo*, in this present writing, which is new to us, namely; that experiments have also been recently made in Titusville, Pa., —another of the oil emporiums—with petroleum gas, the special process used being that of Wren; which has received considerable attention of late, but the peculiar merits of which we have had personally no opportunity to test, in a practical way. It would gratify us to hear something satisfactory as to the success of these Titusville trials of Wren's retorts.

Lack of complete success in this quarter—even if such be reported—will not by any means dishearten us as to the general question. For, as we have repeatedly said, while regarding the use of petroleum as a gas-material, at its present cost, as beyond controversy, we still await evidence as to the superior merits of any among the many—indeed among the thousand and one—processes and apparatuses that have been brought forward, from time to time, by inventors whose name is legion; insomuch that the most disheartening circumstance is the sheer impossibility of keeping track of all these inventions.

Another "writing on the wall," which cheap petroleum interprets into, is its application on a large scale for *fuel* purposes. As a steam fuel, and very especially for locomotives, it is now reasonably certain that methods *must* be found of using it in practice.

Rumors come from different quarters of successful experiments with petroleum-burning locomotives—from the Canada Southern Railway, from the Philadelphia and Baltimore Central Rail Road, from English experiments under the wing of an inventor hight Walker, *et multis aliis*. We must look up again the famous experiments made on a large scale, with locomotives and petroleum, in France, by the great chemist Henri St. Claire Deville, as long ago as 1869; in these times an immense period, so long since as to have been doubtless forgotten by many already. These we say, we shall look up; as we shall doubtless find there almost, if not quite, the whole story—told in advance, but not so very far in advance, of its fulfillment; except that the wheels of time of late have themselves become like locomotive wheels. Let us hope and trustfully believe that these wheels, however, are not whirling upon a *greased track*, and that real progress is being made, and not mere sound and fury born, which signifieth naught. 1873 has given us also reputed improvements in apparatus for producing intensely brilliant lights. With regard to the experiments for increasing the illuminating power of ordinary gas, by the use of oxygen made from the atmosphere—from which we ventured to entertain hopes of benefit to the gas interest, in the way of increasing the amount of candle-power derivable from a given weight of coal—we regret to say that we hear nothing more, not even regarding the ingenious "Vienna oxygen-burner," which was described as so great an improvement. What we now have reference to are reputed improvements in Europe in the American Magneto-electric Machine of Saxton, for engendering the electric light. We hear of a Russian machine, by one Ladiguin, and much more of the French machine of Gramme; the latter having made indeed quite an important stir. It is nevertheless asserted by some that this novel form of the machine, which has been much, and—in view of its great ingenuity—deservedly belauded, is not so well adapted for illuminating purposes as the older one of Wilde, inasmuch as the carbon poles are not found to burn or dissipate so equably. As these statements may emanate, however, from parties in the interest of older machines, we must await further light. Certain is it that such intense lights are imperatively demanded for light house and signal purposes, on land and sea. We do not know how many more *Ville du Havre* horrors will be needed to bring this about in earnest.

Of the Acts of 1873, in affairs of gas and other things belonging to our scope, we might throw out some further remarks, were there more time to spare from the things of the present for those of the past. Nevertheless, in matters of *real* invention it may be denied that *anything* is of the past. We may paraphrase Keats, with a great gain in truth though a woful loss in euphony, and say:—

A thing of utility is a thing forever.

Invention is truly that endowment of man which most assimilates him to his Creator, and separates him from the dumb brute. Language itself is an invention. Some deem it originally an inspiration, but what are inventions—certainly *useful* inventions—but inspirations? The

brute has instinct, which is his endowment, but no invention. Let man therefore cultivate this faculty, which brings him nearer to his God, and which has enabled him—originally a being far more feeble and helpless than the brute—to rise to his present power and intelligence.

MUNICIPAL GAS.

As we are now but spectators of the struggle going on in Great Britain between Municipalities and Gas Companies—our own fast-approaching time being not yet quite at hand—it is well to record facts showing that the argument is not all against the companies. We learn that throughout that kingdom consumers and ratepayers are far from being perfectly content. In Glasgow, a place often quoted for example, the complaints are loud, if not furious. With gas of much the same quality as at Manchester, but at a much higher price (4s. 7d.—say $1·12), the undertaking has been carried on during the past year at a loss of £11,744 ($57,200) and the consumers have stoutly but unsuccessfully resisted any advance in price. The Corporation have just obtained a Provisional Order enabling them to raise the price to 6s., and have fixed the actual price from the 1st inst. at 5s. 5d. In Manchester an advance has been made in spite of urgent remonstrances from consumers impatient of additional taxation.

Let Brooklyn, which has been agitating this question—perpend.

NEW EXCHANGES.

We welcome to our list "*The Sanitarian*" a monthly Journal—A. N. Bell, M. D., Editor.—Publishers, A. S. Barnes & Co., 111 and 113 William street, New York, 36 pp.—$3 per annum.

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ANOTHER.—We are glad to add to our list also the *Oilman's Journal*, published at Parker City (Parker's Landing) in the Oil Regions.

This is a live paper clearly, and is largely made of brief items "boiled down" in fact *distilled* from every part of the oleigenous (or oleaginous, which is it?) "diggings," as well as the comparatively unimportant *residuum* of creation. We heartily advise any party who wishes to be *well* posted (say *rectified*) on oil, to become a subscriber, and hope our contemporary may get "Ten Thousand a Year" of such, though without any "Oily Gammon" in them. Notwithstanding oil is down to a dollar a barrel, the Journal, we doubt not, will "still live," certainly in these *piping* times of peace. Permit us also to hope that the worm of that still is of the species "that never dies." *Confitemus: Peccavimus.* The next time we shall be more *refined* in our expressions, and although this Journal may be distinctly looked upon as *light literature*, we shall infuse a higher degree of gravity into our lucubrations. (Please take notice—this last word is not intended to suggest lubrication, which would be slippery nonsense indeed.)

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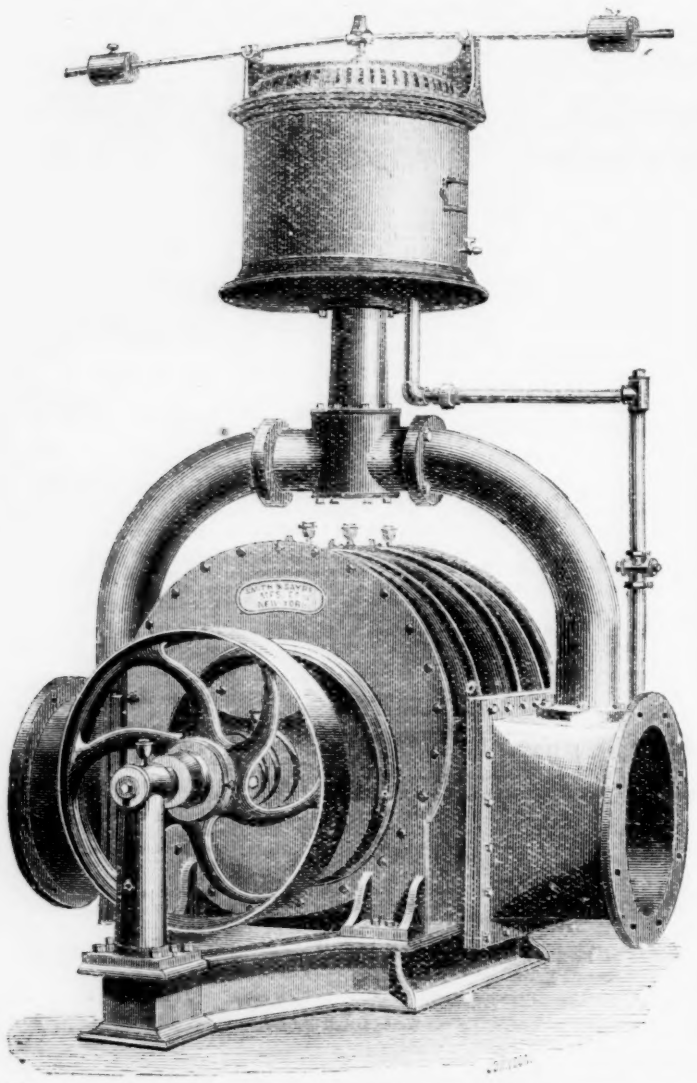

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The saving of lime and labor, as the Screens are not to clog, and are easily cleaned.

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5th. Their DURABILITY—they can be used longer than any her now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFEE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why ey will not last for a long time. The *very large amount of space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yonrs,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3, 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.
SPRINGFIELD, MASS., Oct. 10, 1871.

MR. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable. and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give you my experience. Yours truly,
P. E. DEMILL, Secretary.

We give a list of some Gas-Light Companies using them.

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Address **R. A. POTTER, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass
EDWARD DUFFEE, Agent.

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REFERENCE.—RICHARD MERRIFIELD, Esq., late Vice President MANHATTAN GAS-LIGHT COMPANY.

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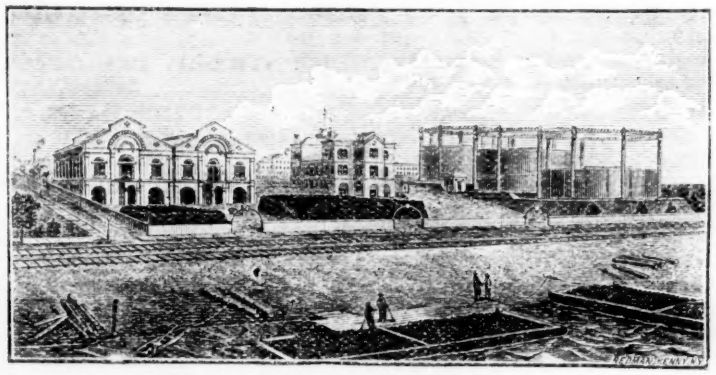

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Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500; $250 additional for each additional 50,000 per day.

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☞ Immediate arrangements are urged, as the demand for c prepared composition is increasing *so rapidly* that delays supply may occur.

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From the Sterling Colliery.

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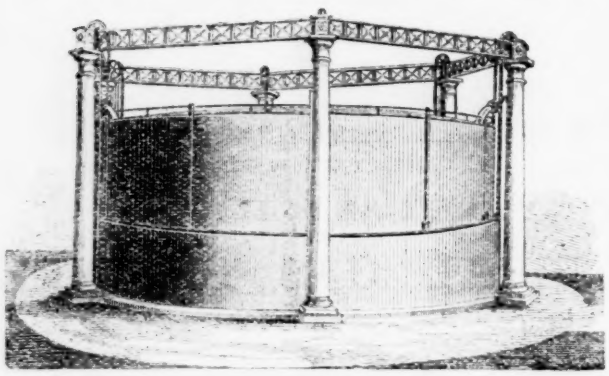

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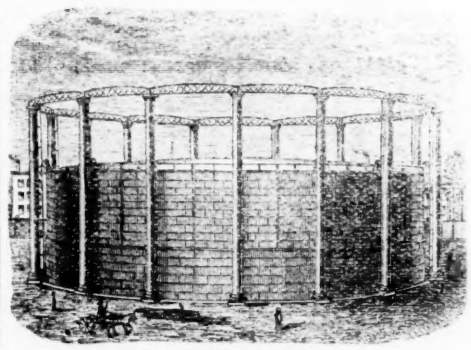

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GAS HEATING AND COOKING APPARATUS,

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As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

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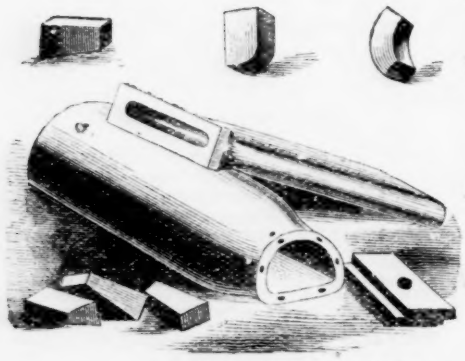

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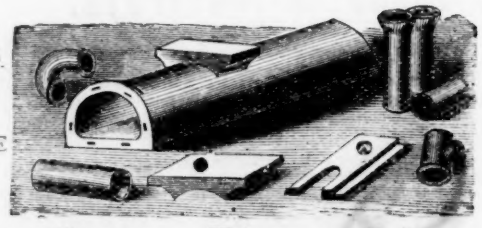

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We hereby caution all parties against making, vending, or using any GAS EXHAUST GOVERNOR that will be an encroachment of our patent.

The support and confidence of Gas Companies, so long enjoyed by us, encourage us to pursue the same undeviating course that has contributed to establish the character of our house, and with our extended experience and increased facilities, develop the latest improvement that Science can apply, in the construction of Gas Meters, etc., and thereby merit a continuance of the favors hitherto so liberally extended to us, always guaranteeing satisfaction.

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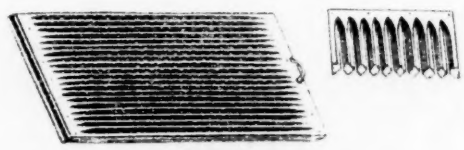

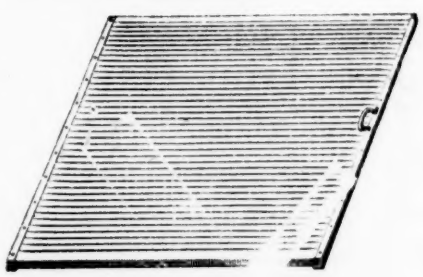

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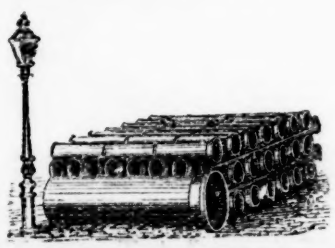

For the accommodation of parties who may want small lots Pipe for *immediate* delivery, we have established a yard in New York City.

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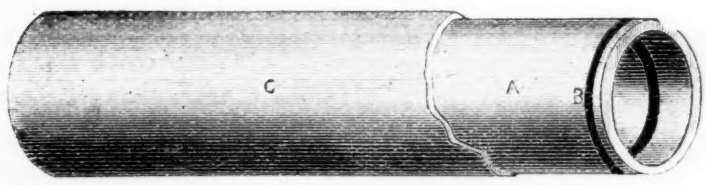
CHICAGO OFFICE, 646 WABASH AVENUE.

SECTION OF GAS PIPE



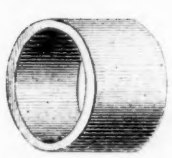


FIG. 2.

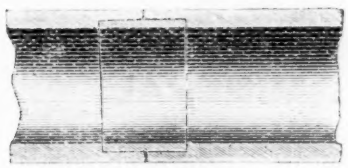


FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

Above is a cut of the

"WYCKOFF PATENT IMPERISHABLE GAS PIPE,"

manufactured by the NORTHWESTERN GAS AND WATER PIPE COMPANY.

This Pipe is made of White Pine, one inch to sixteen inches bore, in sections eight feet long rounded in a lathe, coated inside and out with Asphaltum, connected with a tenon, or socket, and a thimble joint, perfectly air and water tight, being driven together with cement furnished by the Company. When laid its cost is about one half that of Iron Pipe, and is UNQUESTIONABLY the best Gas conducting Main in use.

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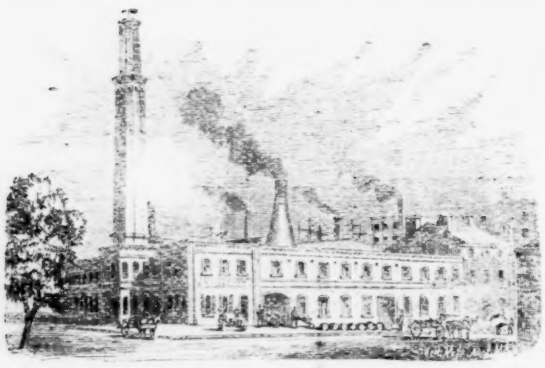

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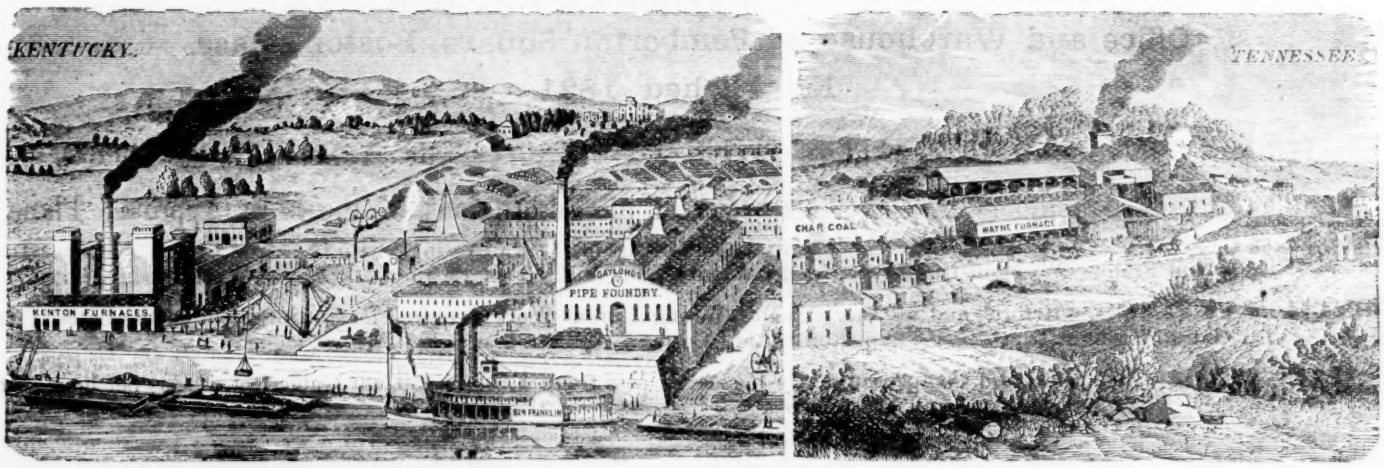

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The many devices lately brought to the notice of the American public, to accomplish the same results are mostly old English contrivances tried and abandoned years ago, on account of the machinery, stuffing boxes, valves, levers, etc., necessary

But the extraordinary results obtained by the McIlhenny process, have induced some unprincipled persons to bring to the notice of the public, as *recent inventions of their own*, some of these old devices; their purpose seems to be simply to evade the patent.

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Yours truly,
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SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

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CONDENSERS.—Single and Multitubular Air and Water Condensers.

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CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

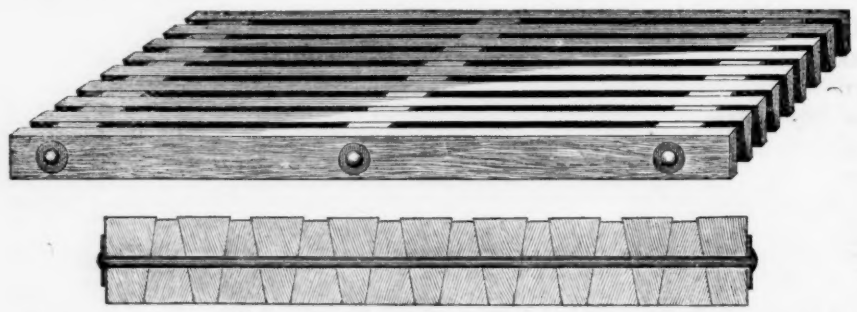
METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas Light Company, N. Y.
Utica Gas-Light Comwany, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.

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